ANNUAL ASSESSMENT REPORT

ELECTRICAL AND COMPUTER ENGINEERING DEPARTMENT

2010-2011

INTRODUCTION

This annual assessment report details the activities, events, decisions and actions in relation to the process of continuous improvement in the Department of Electrical and Computer Engineering. The following sections discuss curricular changes and updates as well as proposed modifications to the data collection process for assessment within the department. We note that these changes are in response to feedback from various constituencies including faculty, students, graduating seniors and the industrial advisory committee. These changes are evidence of an active assessment process within the Department of Electrical and Computer Engineering.

UPDATES ON CURRICULAR CHANGES

Various constituencies provide inputs to the cycle of continuous improvement in the department. One of the areas where input is sought is in the area of the curriculum. Over the past several years, inputs from students, graduates, alumni, industrial advisors, and teachers have been collected. As data have been collected, the department executive committee, curriculum committee, and assessment committee have discussed with faculty ways to respond to data from the constituents. This year, several changes have been made to the curriculum--some changes are major, others are minor. This section documents these curricular adjustments. Since some of the changes apply to undergraduate courses that are taken by both electrical engineering and computer engineering majors, the list here has not been separated based on the program.

1. ECE 3710, Microcomputer Hardware and Software – Two years ago students indicated that the content in this course was outdated. The course was re-organized and modernized around the 8051 microcontroller and modern software tools were introduced. This course was taught for the first time last year by Dr. Fon Brown and the second time this year by Dr. Paul Wheeler. This year Dr. Ryan Gerdes will teach the course. Feedback from students at exit interviews indicated that this change has greatly improved the course and the preparation of students to enter the workforce.
2. ECE 5720, Computer Systems Programming and Architecture – Two years ago, using inputs from students and faculty, ECE 3720 was removed and the material moved to and combined with ECE 5720. This change was made to help prepare students for the graduate program in computer engineering. Dr. Brandon Eames initiated this change, and Dr. Koushik Chakraborty has continued teaching by the same model. Feedback from students in senior exit interviews has been very positive. One student commented that this course convinced him/her to pursue computer engineering.
3. English 3080 – There seems to be a lot of variability in the way that this class is taught. The first year this course was required of our students, they had a very good experience. This year a different teacher taught

the class and the students said they didn't learn anything. More oversight from the ECE department may help to stabilize the quality for students.

4. CS I and CS II (C/C++ programming) – Students feel that they are learning syntax but not good software architecture or software engineering principles. Students emerge from these classes confused about the difference between C and C++. Often they don't feel like they really learn the language until they have to use it in ECE classes. One student observed that the programming projects are like 1980s business applications. Students would like to learn to interface to libraries such as OpenGL.
5. Several years ago, we separated linear algebra and differential equations from one four credit class to two three credit classes. Student feedback indicates that this change is generally helpful.
6. ECE 5410, Solid State Physics – The curriculum committee in the department considered dropping this class. This recommendation was taken to the Industrial Advisory Committee for their input. The IAC viewed the availability of this class as important in the curriculum to support students who want to enter the semiconductor industry. Several members of the IAC work for semiconductor companies. Based on the IAC recommendation, this course will continue in the curriculum.
7. It was decided that the ECE 2700 (Digital Circuits) and ECE 5530 (Digital System Design) course sequence needs a major overhaul. Dr. Winstead and Dr. Roy were appointed to a special committee to look at revising these courses. Their work is still underway and we expect a proposal to update these courses in the fall of 2011.
8. Physics 2210 and 2220 have been 4 credit courses and these 4 credits included a lab component. The Physics Department is changing the courses to include Physics 2215 and 2225 which will be one credit labs added on to create two five credit hour courses. This affects assessment. ABET requires 31.5 credits of math and science with some experimental experience. In the past students have been required to take 28 credits with a 3 credit elective. This leaves us a half credit below the requirement. The new physics labs will help to fill both requirements.
9. The faculty senate at USU voted to discontinue the CIL exam. In the past the CIL exam was one of the means used to assess the ABET ethics outcome. This outcome (outcome F) continues to be assessed in ECE 3810, Engineering Professionalism.

MODIFICATIONS TO ASSESSMENT DATA COLLECTION PROCESS

During the past three years the assessment committee has discussed and experimented with new ways to collect assessment data pertaining to courses and student achievement of the A-K program outcomes. This section describes the updated process for collecting this data. We note that the updated process is not a wholesale replacement of the previously used process. We kept the best of what was in place and made modifications as appropriate.

In considering modifications to the existing process, the assessment committee was guided by three principles: (1) every student should be evaluated on each of the A-K outcomes; (2) the assessment process should not be overly burdensome on faculty; and (3) to the extent possible, data collection for direct measures should be a natural part of course administration. The model described below will be presented to the faculty for a vote at the department fall retreat (August 2011). If adopted, this process will be followed starting in the fall semester of 2011.

MOTIVATING FACTORS

To prepare graduates to attain the program educational objectives, the Electrical Engineering and Computer Engineering Programs within the ECE Department have adopted a set of eleven student outcomes. These coincide

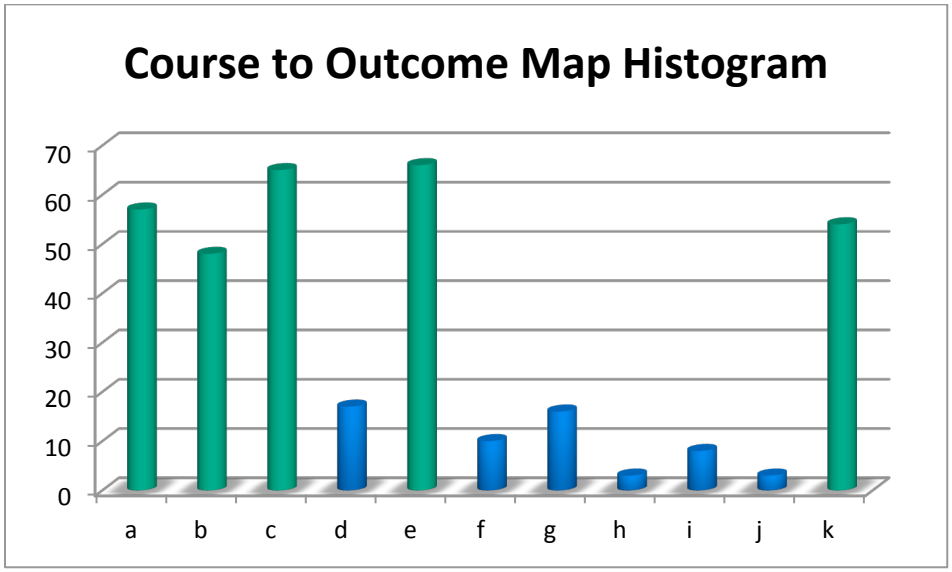
with the ABET Criterion 3 Student Outcomes A-K. As it is important to use multiple methods for assessment, both direct and indirect measures are performed as described below.

Associated with each course in the department are course outcomes. These outcomes are posted to the department web site. Based on these outcomes, a course may support one or more of the A-K student outcomes. As shown below, the course-to-outcome map is organized into a table showing which courses support which of the A through K outcomes. Entries in the table are "2" if the course strongly supports the outcome, "1" if the outcome is weakly supported, and "0" or empty if the outcome is not addressed in the course.

Course to A-K Outcome Map													
Number	Title		a	b	c	d	e	f	g	h	i	j	k
1010	Intro. to ECE		1	1			1	1			1		
2410	Elec. circuits		2	1	1		1						1
2530	Digital circuits		1		2		2		1				2
3410	Microelectronics I		2	2	2		2						2
3620	Circuits and Signals		2	1	1		1						1
3640	Signals and Systems		2	1	1		1						1
3710	Micro.Comp.Hard.&Soft.		1	1	2		2		2				2
3720	Micro.Comp.System Prog.		1		2		2		1		1		2
3820	Design I		1	2	2	2	1	2	2	1	1	1	
4650	Optics I		1	1	1		1						1
4680	Optics II		1	1			1						1
4740	Comp. and Data Commun.		1	1	2		2						2
4840	Design II		1	1	2	2	2	2	2	1	1	1	
4850	Design III		1	1	2	2	2	2	2	1	1	1	
5230	Spacecraft Syst. Engr.		2	1	2	1	1	1	1		1		2
5240	Spacecraft Syst. Design		2	1	2	2	1	1	1		1		1
5310	Control Systems		2	2	2	1	2						2
5320	Mechatronics		2	2	2	1	2						2
5340	Mobile Robots		1	1	2	1	2						1
5420	Microelectronics II		2	2	2		2						1
5430	Applied CMOS Electr.		2	2	2		2						2
5460	Digital VLSI Syst. Design I		2	2	2		2						2
5470	Digital VLSI Syst. Design II		2	2	2		2						2
5480	Electromagnetic Compatibility		2	2	2		2	1	1				2
5530	Digital Systems Design		1		2	2	2		1				2
5630	Intro. to Dig. Sig. Proc		2	1	2		2						2
5640	Real-time processors		2	1	2	1	2		1				2
5660	Communication Syst. I		2	1	2		2		1		1		1
5740	Concurrent programming		1	1	2		2						2
5750	High Performance Mic. Arch		1	1	2		2						2
5770	Microcomp. Interfacing		1	2	2		2						2
5780	Real-time systems		1	2	2		2						2
5800	Electromagnetics II		2		1		1						1
5810	Microwaves I		2	1	1		2						1

5820	Electromagnetics Lab.		1	2	2		2						2
5850	Antennas I		2	1	2		2						1
5870	Wireless Comm. Lab		1	2	2	1	2						1
5820	Electromagnetics Lab.		1	2	1	1	2						1

A histogram of the numerical values beneath each of the A-K outcomes reveals that about half of the outcomes (outcomes A, B, C, E, K) are well supported in the curriculum while about half of the A-K outcomes (outcomes D, F, G, H, I, J) are assessed at a few key points in the curriculum. We refer to outcomes A, B, C, E, K as "hard" outcomes and outcomes D, F, G, H, I, J as "soft" outcomes.



DIRECT ASSESSMENT OF SOFT OUTCOMES

Because the soft outcomes (D, F, G, H, I, J) are supported at only a few points in the curriculum, we naturally evaluate these outcomes at these points. The points below explain how and where direct measures are made for the soft outcomes.

Outcome D – an ability to function an multidisciplinary teams

- Engineering Professionalism, ECE 3810 - EE and CE majors in same class and teams are always mixed. Design package produced as a team and graded by instructor (team grade). Informed observer assigns 0-2 (direct measure).
- Senior exit interviews and questionnaire.

Outcome F - an understanding of professional and ethical responsibility

- ECE 1000 – Ethics quiz. Students in both programs have to pass this before graduation. (direct measure)
- Engineering Professionalism, ECE 3810 - Formal presentations on and teaching about ethics and professional responsibility, unit and case studies.
- English 3080 – Unit on ethics.
- Senior exit interviews and questionnaire.

Outcome G - an ability to communicate effectively

- English 3080 – Extensive writing and evaluation
- Engineering Communication, ECE 4850 – Extensive writing and evaluation
- Engineering Professionalism, ECE 3810
- Senior design documents
- The review of senior projects by a panel of faculty and other reviewers from industry serves as one of the main assessment points for this outcome. Formal presentations, posters, report, written and verbal communication as well as the innovativeness of the project are evaluated. This information is collected on the Senior Project Jury Form.

Outcome H - the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

- ECE 4840/4850 – A requirement of the senior design document asks students to specifically address how their project fits within a global, economic, environmental, and societal context. Students' responses appear in their project reports. This is a direct measure.
- Engineering Professionalism, ECE 3810 – Formal presentation.
- Senior exit interviews and questionnaire.

Outcome I - a recognition of the need for, and an ability to engage in life-long learning

- Engineering Professionalism, ECE 3810 - Students learn about and convey what they learn by reading a five page paper, they give formal presentation, 0-2 assigned. (direct measure)
- Senior exit interviews and questionnaire.

We accept the definition of life-long learning as (1) reviewing fundamentals of electrical and computer engineering; (2) extending knowledge into other fields such as mechanical engineering, physics, chemistry, mathematics, etc.; and (3) having the ability to effectively find information on the Internet.

Outcome J - a knowledge of contemporary issues

- Engineering Professionalism, ECE 3810 - Formal presentation, students write two page paper, 0-2 assigned. (direct measure)

We accept the definition of contemporary issues as (1) events and factors that impact jobs, e.g. outsourcing and the economy; (2) diversity, sexual harassment and workplace issues; (3) issues impacting electrical and computer engineering today. Simply following the latest news headlines is not considered staying abreast of contemporary issues.

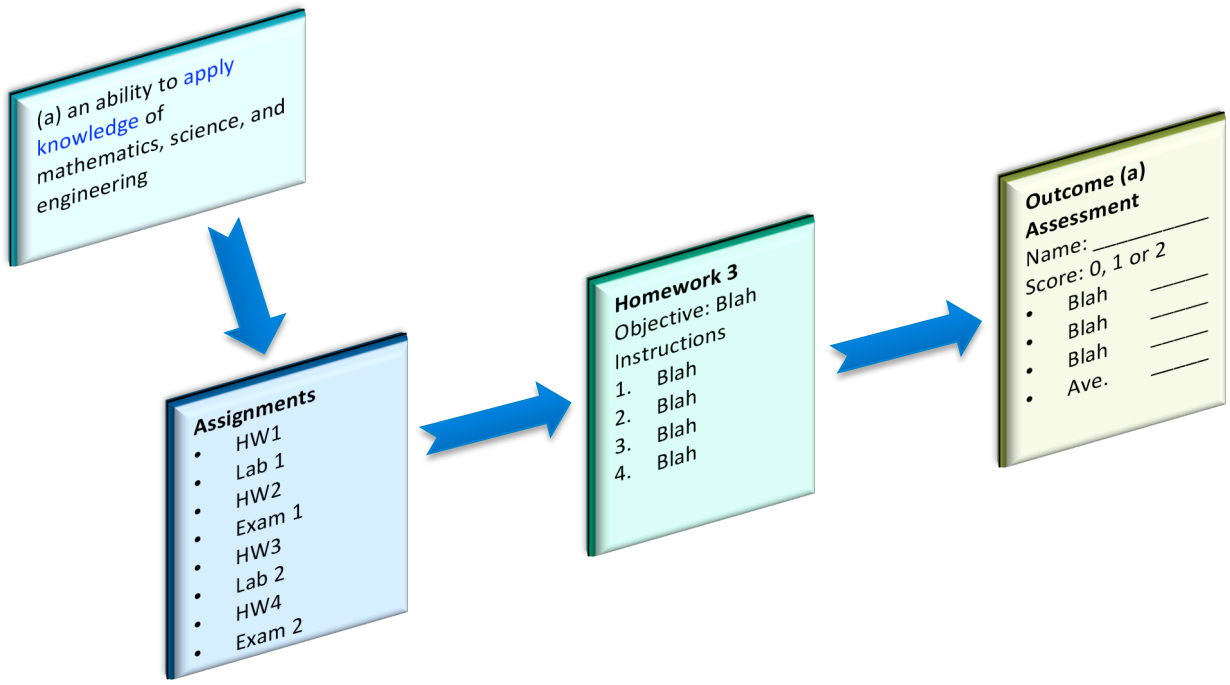
DIRECT ASSESSMENT OF HARD OUTCOMES

Our attitude toward assessing the hard outcomes (A, B, C, E, K) is somewhat different than the soft outcomes because it is evident from the course to outcome map that the hard outcomes are thoroughly assessed across the curriculum. Outcome A, for example, is assessed to some extent in each of our undergraduate courses. However, we do not collect assessment information in each of those courses as we feel that this would create an unnecessary burden for faculty. Instead we make sample assessments of the hard outcomes at only a few places

in the curriculum. These so called special assessments are made in the core classes that all EE and all CE students take. The table below shows which outcomes are attached to which core classes.

Class	Outcome	Semester
ECE 3410 – Microelectronics I	(k)	Spring
ECE 3620 – Circuits and Signals	(a)	Fall
ECE 3640 – Signals and Systems	(b)	Spring
ECE 3710 – Microcomputer HW/SW	(e)	Spring
ECE 4840 – Design II	(c)	Spring
ECE 4850 – Design III	(c)	Fall/Spring

Instructors have some flexibility in how the special assessments are made. The figure below illustrates the process. First an outcome is assigned to a course. The instructor looks at the list of assignments for the course and chooses one that assesses the assigned outcome. Then the instructor prepares a special assessment form for the chosen assignment. This form lists the performance indicators on which students are evaluated. One form is filled out for each student either by the instructor or by the teaching assistant. The assignments are a natural part of the course. The added burden for the instructor is to prepare the special assessment form and to fill out the form based on the students' work or to make sure that the teaching assistant performs this function. These special assessments are saved in a permanent record.



INDIRECT ASSESSMENT

At the end of each semester, a course assessment is completed for each course by the course instructor. To be clear, the course assessment evaluates the students as a whole against the subset of A-K pertaining to the

particular course. It is quantized to the level of a course and summarizes student attainment of the course outcomes on average. In the course assessment instructors also record information about the preparation of students upon entering the course, issues raised in the student course evaluations, and other matters pertaining to the course (what went well/not well, what could be changed to improve the course, etc.). The course assessment provides an indirect measure of student attainment of the course outcomes and the associated student outcomes.

DISCUSSION

The updated assessment of student achievement of the A-K outcomes described above provides for direct assessment of each student on each outcome. It makes point measurements of all the outcomes. The soft outcomes are naturally assessed at the few points in the curriculum where they appear. The hard outcomes are already directly assessed in nearly every course in the curriculum through exams, quizzes, homework, lab reports, project reports, and so on. Special assessments are sample these measurement devices at a few places in the core curriculum. These special assessments explicitly list performance indicators relating to the outcome that is being assessed. By this plan we believe that student attainment of the course and program outcomes can be evaluated, and this can be accomplished without placing an undue burden on faculty.